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10/585,861	06/10/2008	Hidetaka Katougi	Q95344	7728

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EXAMINER	
STAPLETON, ERIC S	

ART UNIT	PAPER NUMBER
3742	

NOTIFICATION DATE	DELIVERY MODE
09/16/2011	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/585,861	KATOUGI ET AL.	
	Examiner	Art Unit	
	ERIC STAPLETON	3742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 July 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *14-25* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *14-25* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *11 July 2006* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *07/11/2006 and 06/06/2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Drawings

The drawings are objected to because Fig. 7B states “SMALL UNLOADING ELECTRIC-DISCHARGE COUN". Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet” pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 14-25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 14-21 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are:

claims 14, 17 and 20 recite an electric-discharge generation counter for counting in response to the waveform an electric-discharge generation count Nd during the predetermined sampling time Ts without associating the electric-discharge generation counter with the claimed structure;

claims 15-16, 18-19 and 21 merely recite mathematical formulas and functional limitations but do not add any structure to the apparatus; and

claims 15-21 do not recite an element for controlling a machining axis so that Vg agrees with SV.

Claims 22-25 rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps are:

claims 22-25 do not recite active steps for determining all of the recited variables; and

claim 22-25 do not recite a step where Vg agrees with SV.

Claims 14, 17, 20, 22 and 25 recite the limitation "the waveform". There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor

and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 14-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,598,075 A to Liang et al., hereinafter, "Liang."

Liang discloses:

Regarding claim 14: an electric-discharge machining apparatus for controlling a machining axis so that a machining average voltage Vg during a predetermined sampling time Ts agrees with a servo standard voltage SV (Fig. 3; col 3, ln 21-36 and col 4, ln 1-23), the apparatus comprising:

an electric power supplier for supplying electric power between electrodes of a tool electrode (discharging electrode) and a target (workpiece) to be machined (Fig. 3 and col 3, ln 21-36);

an electric-discharge detection circuit (discharge detection circuit 8) for detecting the waveform of electric discharge generating between the electrodes based on the electric power supplied by the electric power supplier (col 3, ln 21-36);

an electric-discharge generation counter for counting in response to the waveform an electric-discharge generation count Nd during the predetermined sampling time Ts (short-circuit detection circuit, coupled to discharge detection circuit, counts discharge) (col 2, ln 45-50);

a calculator (averaging circuit 12) for calculating an estimation average voltage Vgs between the electrodes (Fig. 3 and 4; col 3, ln 37-67); and

an electrode-position controller (servo control apparatus) for controlling the machining axis (col 4, ln 1-23) so that the estimation average voltage Vgs calculated by the calculator agrees with the servo standard voltage SV during the sampling time Ts (col 2, ln 38-58);

Regarding claim 17: an electric-discharge machining apparatus (Fig. 3 and col 3, ln 21-36) for controlling a machining axis so that a machining average voltage Vg during a predetermined sampling time Ts agrees with a servo standard voltage SV (Fig. 3; col 3, ln 21-36 and col 4, ln 1-23), the apparatus comprising:

an electric power supplier for supplying electric power between electrodes of a tool electrode (discharging electrode) and a target (workpiece) to be machined (Fig. 3 and col 3, ln 21-36);

an electric-discharge detection circuit (discharge detection circuit 8) for detecting the waveform of electric discharge generating between the electrodes based on the electric power supplied by the electric power supplier (col 3, ln 21-36);

an electric-discharge generation counter (discharge detection circuit 8 and short-circuit detection circuit 9) for counting in response to the waveform an electric-discharge generation count Nd during the predetermined sampling time

Ts (short-circuit detection circuit, coupled to discharge detection circuit, counts discharge) (col 2, ln 45-50);

a short-circuit generation counter (discharge detection circuit 8 and short-circuit detection circuit 9) for counting a short-circuit count N1 of short-circuit electric discharge in which the voltage of electric discharge accompanied by the applied voltage supplied by the electric power supplier is lower than a predetermined short-circuit threshold voltage Vsh (col 2, ln 40-50 and col 3, ln 25-45);

a small unloading electric-discharge counter (voltage divider 7 and sample-and-hold circuit 11) for counting a small unloading electric-discharge count N2 of electric discharge to which the applied voltage supplied by the electric power supplier changes within a predetermined small unloading time Tdo (Fig. 2-4; col 3, ln 21-55);

a calculator (averaging circuit 12) for calculating an estimation average voltage Vgs between the electrodes (Fig. 3 and 4; col 3, ln 37-67); and

an electrode-position controller (servo control apparatus) for controlling the machining axis (col 4, ln 1-23) so that the estimation average voltage Vgs calculated by the calculator agrees with the servo standard voltage SV during the sampling time Ts (col 2, ln 38-58);

Regarding claim 20: an electric-discharge machining apparatus (Fig. 3 and col 3, ln 21-36) for controlling a machining axis so that a machining average voltage Vg during a predetermined sampling time Ts agrees with a servo

standard voltage SV (Fig. 3; col 3, ln 21-36 and col 4, ln 1-23), the apparatus comprising:

an electric power supplier for supplying electric power between electrodes of a tool electrode (discharging electrode) and a target (workpiece) to be machined (Fig. 3 and col 3, ln 21-36);

an electric-discharge detection circuit (discharge detection circuit 8) for detecting the waveform of electric discharge generating between the electrodes based on the electric power supplied by the electric power supplier (col 3, ln 21-36);

an electric-discharge generation counter (discharge detection circuit 8 and short-circuit detection circuit 9) for counting in response to the waveform an electric-discharge generation count Nd during the predetermined sampling time Ts (short-circuit detection circuit, coupled to discharge detection circuit, counts discharge) (col 2, ln 45-50);

a small unloading electric-discharge counter (Fig. 2 and 4; col 3, ln 21-55);

a calculator (averaging circuit 12) for calculating an estimation average voltage Vgs between the electrodes (Fig. 3 and 4; col 3, ln 37-67); and

an electrode-position controller (servo control apparatus) for controlling the machining axis (col 4, ln 1-23) so that the estimation average voltage Vgs calculated by the calculator agrees with the servo standard voltage SV during the sampling time Ts (col 2, ln 38-58);

Regarding claim 22: an electric-discharge machining method of controlling a machining axis (col 1, ln 51-52) so that a machining average voltage Vg during a predetermined sampling time Ts agrees with a servo standard voltage SV (col 3, ln 46-67 and col 4, ln 1-23), the method comprising:

a step of detecting the waveform of electric discharge generating, based on supplied electric power, between electrodes of a tool electrode and a target to be machined (Fig. 2 and 3; col 3, ln 20-30);

a step of counting in response to the waveform an electric-discharge generation count Nd during the predetermined sampling time Ts (col 3, ln 30-35);

a step of calculating an estimation average voltage Vgs between the electrodes (col 3, ln 55-67); and

a step of controlling the machining axis so that the estimation average voltage Vgs calculated agrees with the servo standard voltage SV within the sampling time Ts (col 4, ln 1-23); and

Regarding claim 25: an electric-discharge machining method of controlling a machining axis (col 1, ln 51-52) so that a machining average voltage Vg during a predetermined sampling time Ts agrees with a servo standard voltage SV (col 3, ln 46-67 and col 4, ln 1-23), the method comprising:

a step of detecting the waveform of electric discharge generating, based on supplied electric power, between electrodes of a tool electrode and a target to be machined (Fig. 2 and 3; col 3, ln 20-30);

a step of counting in response to the waveform an electric-discharge generation count Nd during the predetermined sampling time Ts (col 30-35);

a step of calculating an estimation average voltage Vgs between the electrodes(col 3, ln 55-67); and

a step of controlling the machining axis so that the estimation average voltage Vgs calculated agrees with the servo standard voltage SV during the sampling time Ts (col 4, ln 1-23).

Liang fails to disclose:

Regarding claim 14: calculating an estimation average voltage Vgs between the electrodes, based on:

$$Vgs = V0 - \frac{Nd}{Ts} \times \{Ton \times (V0 - eg) + Toff \times V0\}$$

where Nd is the electric-discharge generation count, V0 is a predetermined applied voltage, Ton is a pulse width, Toff is a rest time, eg is an electric-discharge voltage, and Ts is the sampling time (as recited in claim 14);

a short-circuit generation counter for counting a short-circuit count N1 of short-circuit electric discharge in which the voltage of electric discharge accompanied by the applied voltage supplied by the electric power supplier is lower than a predetermined short-circuit threshold voltage Vsh, wherein calculation of the estimation average voltage Vgs by the calculator is compensated (as recited in claim 15);

the estimation average voltage Vgs is calculated by:

$$Vgs = V0 - \frac{Nd - N1}{Ts}\{Ton(V0 - eg) + Toff \times V0\} - \frac{N1}{Ts}\{V0 \times (Ton + Toff)\}$$

(as recited in claim 16);

calculating an estimation average voltage Vgs between the electrodes, based on the electric-discharge generation count Nd, the short-circuit count N1, the small unloading electric-discharge count N2, and the abnormal electric-discharge count N3 (as recited in claim 17);

the estimation average voltage Vgs is calculated considering rest-time extension based on the electric-discharge generation other than normal electric-discharge generation (as recited in claim 18);

the estimation average voltage Vgs is calculated by:

$$Vgs = V0 - \frac{Nd - N1}{Ts}\{Ton(V0 - eg) + Toff \times V0\}$$

$$- \frac{N1}{Ts}\{V0(Ton + Toff)\} - \frac{1}{Ts}\{V0(N1 \times Toffs1 + N2 \times Toffs2 + N3 \times Toffs3)\}$$

;

where Toffs1 is a rest time according to the short circuit, Toffs2 is a rest time according to the small unloading electric discharge, and Toffs3 is a rest time according to the abnormal electric discharge (as recited in claim 19);

a small unloading electric-discharge counter for counting a small unloading electric-discharge count N2 of electric discharge to which electric discharge accompanied by the applied voltage supplied by the electric power supplier changes within a predetermined small unloading time Tdo; a calculator for calculating an estimation average voltage Vgs between the electrodes, based on the electric-discharge generation count Nd, and the small unloading electric-discharge count N2 (as recited in claim 20);

the small unloading time Tdo is set to 0.3-0.5 times a limited unloading time Tds calculated based on the average current density Id of the electric discharge (as recited in claim 21);

calculating an estimation average voltage Vgs between the electrodes, based on the electric-discharge generation count Nd, and based on:

$$Vgs = V0 - \frac{Nd}{Ts} \times \{Ton \times (V0 - eg) + Toff \times V0\}$$

;

where V0 is a predetermined applied voltage, Ton is a pulse width, Toff is a rest time, eg is an electric-discharge voltage, and Ts is the sampling time (as recited in claim 22);

the estimation average voltage Vgs is obtained by counting a short-circuit count N1 of short-circuit electric discharge in which the voltage of electric

discharge accompanied by the applied voltage supplied by an electric power supplier is lower than a predetermined short-circuit threshold voltage Vsh, and by compensating using:

$$Vgs = V0 - \frac{Nd - N1}{Ts}\{Ton(V0 - eg) + Toff \times V0\} - \frac{N1}{Ts}\{V0 \times (Ton + Toff)\}$$

(as recited in claim 23);

the estimation average voltage Vgs is obtained by counting a short-circuit count N1 of short-circuit electric discharge in which the voltage of electric discharge accompanied by the applied voltage supplied by an electric power supplier is lower than a predetermined short-circuit threshold voltage Vsh, a small unloading electric-discharge count N2 of electric discharge to which the applied voltage supplied by the electric power supplier changes within a predetermined small unloading time Tdo, and an abnormal electric-discharge count N3 of abnormal electric discharge whose voltage reaches a lower value than a predetermined abnormal electric-discharge threshold voltage Vng, and by using:

$$Vgs = V0 - \frac{Nd - N1}{Ts}\{Ton(V0 - eg) + Toff \times V0\}$$

$$- \frac{N1}{Ts}\{V0(Ton + Toff)\} - \frac{1}{Ts}\{V0(N1 \times Toffs1 + N2 \times Toffs2 + N3 \times Toffs3)\}$$

;

where Toffs1 is a rest time according to the short circuit, Toffs2 is a rest time according to the small unloading electric discharge, and Toffs3 is a rest time according to the abnormal electric discharge (as recited in claim 24); and

a step of counting a small unloading electric-discharge count N2 of electric discharge to which electric discharge accompanied by the applied voltage supplied by an electric power supplier changes within a predetermined small unloading time Tdo; and calculating an estimation average voltage Vgs between the electrodes, based on the electric-discharge counts Nd, and N2 (as recited in claim 25).

However, regarding claims 14-25, it would have been obvious to one of ordinary skill in the art at the time of invention to derive equations for calculating an estimation average voltage Vgs based on a variety of equations, circuits and variables disclosed in Liang. Applicant is reminded that patentability should not be based on a mathematical formula. See MPEP 2106.02. Liang discloses time values corresponding to the claimed time values, count values, voltages and current. Liang discloses the time values of Fig. 2 as well as the elements of the circuits of Fig. 5 and 6. It would have been obvious to one of ordinary skill to consider times and waveform diagrams such as those of Fig. 2 and 4 of Liang for the circuits of Fig. 5 and 6 of Liang. Liang further discloses count values corresponding to the claimed count values. Liang discloses counts related discharge, short-circuit condition and abnormal electric discharge (col 2, ln 40-50

and col 3, ln 30-36). It would have been obvious to one of ordinary skill to consider counts for the values and circuits of Fig. 2-4 based on the count values and circuits of Liang. Liang also discloses a number of voltage variables and calculations (col 1, ln 25-45, col 2, ln 5-37 and col 3, ln 21-67) along with the circuits of Fig. 3, 5 and 6 which correspond to the claimed voltages. It would have been obvious to one of ordinary skill to consider voltages for the circuits of Liang and derive equations for calculating average voltage based on the voltages, average voltage equations and circuits of Liang. It is also noted that it would have been obvious to one of ordinary skill in the art to consider current density, as current is associated with the voltages and circuits of Liang and current is also mentioned in Liang (col 4, ln 2-4). Moreover, Liang discloses monitoring and calculating average voltage in order to allow the servo control apparatus to respond quickly to retreat the discharging electrode, along an axis, away from the working piece to prevent or reduce damage to the discharging electrode (Liang: col 3, ln 55-67 and col 4,ln 1-23).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ERIC STAPLETON whose telephone number is (571)270-3492. The examiner can normally be reached on Monday - Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Henry Yuen, can be reached on (571) 272-4856. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/E. S./
Examiner, Art Unit 3742
September 9, 2011

/Henry Yuen/
Supervisory Patent Examiner, Art Unit 3742